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International Society for the History and Bibliography of Herpetology



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### The Society

The **ISHBH** is a not-for-profit organization established to bring together individuals for whom the history and bibliography of herpetology is appealing, to promote the knowledge of related topics among members and the general public, and to promote research. Membership is open to anyone who shares the aims of the Society.

### Membership

The fees for three years 2010 to 2012 (*Bibliotheca Herpetologica* vols. 9 and 10) are as follows: Benefactor US\$100, Sponsoring US\$50, and Regular US\$30. Lifetime membership starting from 2010 (vol. 9) is US\$300. Institutions pay minimum US\$50. The fee includes a subscription for two volumes of the Society's journal *Bibliotheca Herpetologica*. A membership application form that includes the possibility to order back issues can be found on our website. Payment can be made by personal check or money order in USD drawn on a US bank sent to the Secretary-Treasurer or the Chairperson. Payment can also be made by transfer in euro to PlusGiro, Sweden, IBAN SE83 9500 0099 6042 0455 1206, BIC NDEASESS. Payment by credit card can be made on the website ZenScientist, [www.zenscientist.com](http://www.zenscientist.com), with an additional cost of 10%. This website is run by Breck Bartholomew, Utah, USA. It can be used also for applying for membership to many other national and international herpetological societies. ZenScientist.com is designed to promote communication and collaboration within the herpetological community. Try it!

Members are encouraged to contribute with articles, essays, news of meetings, hints on antiquarian trade, book reviews and other issues associated with herpetology. The Society organizes seminars, visits to libraries, museums, etc. in connection with herpetological meetings with international participation. The Society works to facilitate informal contacts among members so that the members can meet, offer support in knowledge and transact exchanges of literature.

Correspondence to the Society shall be addressed directly to a Committee member or officer, either by post or email.

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*Meeting Organizer:* Aaron Bauer, Department of Biology, Villanova University, 800 Lancaster Avenue, Villanova, PA 19085-1699, USA, [aaron.bauer@villanova.edu](mailto:aaron.bauer@villanova.edu)

*Editor:* Cistopher J. Bell, Dept. of Geological Sciences, University of Texas, 1 University Station C1100, Austin, TX 78712-0254, USA, [cjbell@mail.utexas.edu](mailto:cjbell@mail.utexas.edu)

### Other officers

*Managing Editor and Webmaster:*  
Ralph Tramontano, PO Box 781, Morehead City, NC 28557, USA, [rrtramon@t-ad.net](mailto:rrtramon@t-ad.net)

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Authors submitting a manuscript do so on the understanding that the work has not been published before and is not being considered for publication elsewhere. Manuscripts are peer reviewed.

The language of *Bibliotheca Herpetologica* is English. Color illustrations other than used for the cover will be at the author's expense. See the ISHBH website for more details: [www.t-ad.net/ishbh/author.html](http://www.t-ad.net/ishbh/author.html)

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## Society News

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### The Society Meeting 2011

Members of the Society met in 2011 in conjunction with the Joint Meeting of Ichthyologists and Herpetologists that was held in Minneapolis, Minnesota, USA. The annual meeting took place on Friday, July 8th and was followed by a tour of the Wangensteen Historical Library of Biology and Medicine. With nearly 70,000 volumes it is considered to have one of the country's finest collections of rare biological and medical books. It has over one hundred, many old and scarce, herpetological works. The Curators Elaine Challacombe and Lois Hendrickson had a nice selection of books laid out for our viewing such as John Anderson's (1896) *Herpetology of Arabia*, Harold L. Babcock's (1919) *The Turtles of New England*, Joseph Fayrer's (1872) *The Thanatophidia of India*, and John Edwards Holbrook's (1842) *North American Herpetology*. An old cookbook that had a turtle soup recipe was a highlight of a special kind. ISHBH, as a token of gratitude, presented the library with a copy of Ernest A. Liner's (2005) *The Culinary Herpetologist*, thus significantly increasing the number of recipes on herpetological specimens (in a folkloristic sense) available for the library students, alumni and the general public.

### Membership Status

By mid-2012, the number of members is 150, an increase of 35 since the year-end 2010. Much of the growth is attributable to the phenomenal service that ZenScientist ([www.zenscientist.com](http://www.zenscientist.com)) provides. ZenScientist, run by Breck Bartholemew, administers on their website membership service for a dozen herpetological associations with international membership scope, allowing payment with credit cards or off-line. Many are those who discovered ISHBH in connection with the payment of the dues of other societies. The fact remains, however, that we are still a moderate association by any standard but with an excellent international distribution. We have members in 20 countries from all continents except Africa and Antarctica. Twenty are members for life, 17 have membership as a sponsor or benefactor, 12 are institutional (libraries) and the

rest are regular members. To reduce the administrative burden on the Treasurer and for the members it was chosen already when the association was formed in 1999 that membership takes place in periods of two years. To be in pace with the issuance of *Bibliotheca Herpetologica* the biennial period has sometimes been extended for one year at no charge to ensure that two volumes are included in each membership period. So regardless what other sites mention the current membership period is 2010 to 2012. Current members have already received *Bibliotheca Herpetologica* volume 9 and now the 1<sup>st</sup> issue of volume 10. That said we want to encourage our members to recruit new members among colleagues, friends, teachers, students, and relatives. Members signing up this year will receive a copy of the special issue *The Herpetological Legacy of Linnaeus* as well as volume 10. Current members will be contacted with renewal details in connection with the issuance of volume 10, number 2 that is planned for December.

### The Society Meeting 2012

The Business meeting for 2012 was held in Vancouver, Canada in conjunction with 7<sup>th</sup> World Congress of Herpetology at noon on Aug. 10. 13 members and 2 guests attended. The Financial Statement, which is available online ([t-ad.net/ishbh/bokslut2011.pdf](http://t-ad.net/ishbh/bokslut2011.pdf)), was approved.

### ABOUT THE COVER

Of the four Swinhoe's softshell turtles known to exist today, only two are known to survive in the wild, both in northern Vietnam. One of these turtles, rumored by some to be the Sword Lake Turtle of Vietnamese legend, resides in Hoàn Kiếm Lake in central Hanoi. On Hoàn Kiếm's northernmost islet, the Tháp Rùa (Turtle Tower) was purportedly built ca. 1886 in memory of the Golden Turtle who guards Lê Lợi's magic sword. Today, the grassy margins of the island provide the only basking and nesting habitat remaining for this lone turtle. Courtesy Education for Nature-Vietnam in cooperation with the Asian Turtle Program; Artist Nguyen Doan Son.

# **Swinhoe's Softshell Turtle (*Rafetus swinhoei*): The Legendary Sword Lake Turtle of Hoan Kiem Lake**

Matthew P. Bettelheim

1333 Broadway, Suite 800, Oakland, CA 94612, USA, matthew.bettelheim@urs.com

There is a story – a legend – told by the people of Vietnam that there was once a farmer king with a magical sword who delivered their country from the ravaging armies of the north. This sword, it is said, was a gift from the Dragon King who called upon his messenger the Golden Turtle to deliver the blade to the farmer king. With the Dragon King's sword in hand, the farmer king rallied his countrymen, repelled the invaders, and took the throne. Not long thereafter, the new king was boating on a lake when the Golden Turtle surfaced, retrieved the sword, and disappeared into the lake's depths. The king renamed the lake "The Lake of the Returned Sword" and his reign, though short, marked the beginning of a golden age (Trang 2006). Nearly six hundred years after this legend first took root, a creature began to stir in the murky depths of that very same lake. As time passed, the creature was increasingly seen breaching the lake's still waters and basking on one of the lake's islands. Some who saw it said it was a monstrous turtle – some even said it was the Golden Turtle itself. Soon there was little doubt; the Golden Turtle had returned.

If this legend seems the stuff of fairy tales, think again. The legend of the Sword Lake Turtle is founded on historical fact. The farmer king is none other than Emperor Lê Lợi, founder of the Vietnamese Lê Dynasty (Trang 2006, Friends of Vietnam Heritage 2008). The Lake of the Returned Sword is none other than Hồ Hoàn Kiếm, a lake in Hanoi, the capital city of Vietnam (Trang 2006, Friends of Vietnam Heritage 2008). And most importantly, the Golden Turtle (Kim Qui), who has resurfaced in the corporeal form of a Swinhoe's softshell turtle (*Rafetus*

*swinhoei*; Friends of Vietnam Heritage 2008), the rarest freshwater turtle in the world.

For a turtle that has figured so prominently in Vietnam's folklore for nearly six hundred years, the Swinhoe's softshell turtle has received little exposure in the scientific community since it was first described in 1873, more than 130 years ago. It was not until reports of a legendary turtle in Hoàn Kiếm Lake surfaced in the late 1990's that the link between the Swinhoe's softshell turtle and the Sword Lake Turtle legend was established, catching the attention and imaginations of Hanoians and herpetologists alike. Such attention was warranted, given only four living Swinhoe's softshell turtles are presently known to exist – two in captivity, two in the wild – and its listing by the IUCN Red List as a critically endangered species (Asian Turtle Trade Working Group 2000). The alarming rarity of the Swinhoe's softshell turtle today is matched only by the scarcity of scientific literature describing the natural history of the species. Only Gray (1873), Heude (1880), and Pritchard (2001, 2005) significantly address aspects of the species' natural history; the remaining literature deals primarily with phylogeny (Meylan 1987, Engstrom et al. 2004) or a combination of taxonomy, *species novum*, and nomenclatural revisions (Boulenger 1889, Baur 1893, Siebenrock 1902, Pope 1935, Zhang 1984, Tao 1986, Meylan and Webb 1988, Farkas 1992, Niekisch et al. 1997, Zhao 1997, Farkas and Fritz 1998, S.A. 1999, Dúc 2000a,b, Farkas and Webb 2003, Fritz and Havas 2006, Turtle Taxonomy Working Group 2007, Le et al. 2010, Farkas et al. 2011). This article contributes the first comprehensive review of the species' history and natural history and the legend of the



Sword Lake Turtle together in the English language for western audiences.

Since the early 1990s, only nine living Swinhoe's softshell turtles have been confirmed in the wild or in captivity: seven captive turtles in the People's Republic of China (China) and two wild ones in Vietnam. As early as 1949, when the People's Republic of China gained independence, six Swinhoe's softshell turtles were known to have been held in Chinese zoological collections: two in the West Garden Buddhist temple in Suzhou, Jiangsu province; two in the Suzhou Zoo; one in the Shanghai Zoo, Yunnan province; and one in the Beijing Zoo (Kuchling and Shunqing 2007, Kuchling 2008).

Over the years, natural deaths took their toll, quietly crippling the world's zoological collections. The first such incident occurred at Suzhou Zoo in the early 1990s when a supposed female Swinhoe's softshell turtle was introduced into Suzhou Zoo's resident male's enclosure to attempt breeding (G. Kuchling, pers. comm). The breeding attempt quickly deteriorated when the two males, as it was later confirmed, erupted in an "epic battle," leading to the death of the presumed female (Kuchling 2008, p. 4; G. Kuchling, pers. comm.). Then, in 2005 and 2006, the males at first the Beijing Zoo and then the Shanghai Zoo died unexpectedly (Kuchling and Shunqing 2007, Kuchling 2008, G. Kuchling, pers. comm.). Tragedy next struck the West Garden Buddhist temple, where a male believed by the monks to have inhabited the garden for over 400 years died in August 2007; the second West Garden turtle, which hasn't been observed in several years (as of 2008), may also have met a similar fate (Kuchling and Shunqing 2007, Kuchling 2008).

In Vietnam's Hoàn Kiếm Lake, anecdotal accounts of individual Swinhoe's softshell turtles had surfaced over the years. According to Vietnam National University of Hanoi biology professor Hà Đình Đức, one Swinhoe's softshell turtle is said to have died in 1963 at the hands of hungry soldiers on night patrol (Overland 2005). Another male *Rafetus* was found dead along the

lake shoreline in 1967 followed by the recovery of a female in 1968 whose skeleton is now housed in the Hanoi Museum (Farkas and Webb 2003). And several years later in 1993, a fourth was caught in Quỳnh Lâm Swamp near Hòa Bình, Hòa Bình province, and placed in a hotel swimming pool before it died, whereupon it was stuffed and put on display in Hòa Bình's municipal museum (Farkas and Webb 2003, Pritchard 2001, Pritchard 2005). Yet another died in 1995 in transport before it was confiscated from a railway passenger at the Hanoi Railway Station en route from the city of Vinh, Nghệ An province (Pritchard 2001, Pritchard 2005).

Still, local Hanoians continued to report the occasional monstrous turtle in the waters of Hoàn Kiếm Lake. As sightings multiplied between 1998 and the present, news outlets across the globe began to cover the story of the purported Sword Lake Turtle of lore (see for example Associated Press 1998, Overland 2005). The public was equally enthusiastic. On November 3, 2005, an unidentified photographer was arrested after he paddled a small boat out to the Tháp Rùa island in Hoàn Kiếm Lake to photograph the legendary turtle basking there on the shoreline (Asian Turtle Conservation Network 2005). By 2000, Hoàn Kiếm's lone Swinhoe's softshell turtle was the only known living specimen of its kind remaining in the wild.

Not long after the Shanghai Zoo's turtle died in 2006, the world's Swinhoe's softshell turtle experts convened that September in Suzhou to participate in the *Rafetus* Conservation Workshop to develop a conservation plan in the hopes of saving the species from extinction. Out of that workshop several new initiatives were born: a captive breeding program, a movement to re-examine zoological collections for potentially misidentified or overlooked individuals, field surveys to locate wild populations, and education and research programs (Asian Turtle Conservation Network 2006, Kuchling and Shunqing 2007).

The search for additional turtles – in the wild or in captivity – was crucial to the success of the

captive breeding program. A breakthrough came in January 2007 when, responding to Wildlife Conservation Society (WCS) circulars asking zoos and parks to reexamine any large softshell turtles in their live collections, the Changsha Zoo, Hunan province, announced that its collections included an unidentified softshell turtle that had been purchased from a traveling circus 50 years ago matching the circular's description. Researchers rushed to the zoo and, to their surprise, found that the mystery turtle was not only a Swinhoe's softshell turtle, it was also a fertile female. With that realization, the proposed captive breeding program – until then a long-shot – had become possible. The Changsha turtle became known affectionately as 'China Girl' (Davies 2008).

Another priority identified during the September 2006 workshop was sexing known individuals (Asian Turtle Conservation Network 2006). Up until then, experts had been uncertain whether Swinhoe's softshell turtles exhibited sexual dimorphism (Pritchard 2001). Such confusion, for example, was responsible for the fatal incident at the Suzhou Zoo where two males were brought together to attempt breeding (G. Kuchling, pers. comm.). In early 2007, Dr. Gerald Kuchling of the University of Western Australia was called on to sex the world's remaining Swinhoe's softshell turtles by palpating the tail to ascertain thickness and the proximity of the cloacal opening to the posterior carapace rim. The deceased, mounted specimen at the Shanghai Zoo and the two remaining live turtles at the Suzhou Zoo and the West Garden Buddhist temple (before its August 2007 death) were all determined to be males, leaving China Girl in the Changsha Zoo the only known female of her kind. Based on the admittedly small sample size, the tails of the three males were generally longer with a thicker base and a cloacal opening in line with or behind the carapace rim. China Girl's tail was slightly shorter with a cloacal opening in line with, or slightly anterior to, the carapace rim; the only obvious sexually dimorphic characteristic evident was the comparatively larger body size of males (Kuchling and Shunqing 2007).

The following year, the search for living specimens in the wild made headlines when a team of experts from Cleveland Metroparks Zoo's Asian Turtle Program and Education for Nature-Vietnam, responding to local reports describing giant softshell turtles in the Son Tay province, announced in April that they had successfully photographed and confirmed a second wild individual west of Hanoi in Đồng Mô Lake (Cleveland Metroparks Zoo 2008, Hendrie 2009). Later that year, the story took a curious development when the prodigal turtle disappeared after floods washed out Đồng Mô's dam. Weeks passed before local fisherman Nguyễn Văn Toàn announced on November 26 that he had caught the turtle downstream of the dam-break, and that a local Hanoi restaurateur had offered him 30 million Vietnamese dong (US \$4,800) for the turtle (Associated Press 2008, Stocking 2008; Figure 1). Toàn argued with authorities for several hours, holding them at bay with a stick and demanding US \$1,400 for the turtle's release, before accepting their offer that he turn over the turtle in exchange for US \$200 and replacement nets (Associated Press 2008, Stocking 2008). After the turtle's release was negotiated, the Đồng Mô turtle was safely returned to its lake (Hendrie 2009).

Although the Đồng Mô turtle had narrowly defeated death, by the close of 2008 more than half of the world's known living specimens had died or disappeared. Today, four Swinhoe's softshell turtles remain in captivity or in the wild: the remaining male at Suzhou Zoo, China Girl at Changsha Zoo, and the two wild males in Đồng Mô Lake and Hoàn Kiếm Lake, where the Sword Lake Turtle legend was born.

Presently, Hoàn Kiếm Lake – straddled lengthwise by Lê Thái Tổ Street to the west and Đinh Tiên Hoàng Street to the East – has become the historical center of Hanoi, the capital city of Vietnam (Friends of Vietnam Heritage 2008). Hoàn Kiếm's idyllic urbanized setting belies the dirty secrets of a lake plagued with Hanoi's raw sewage and pollutants (Overland 2005, Sterling et al. 2006) and whose shoreline has been paved over (Sterling et al. 2006). From the lake's two

islets loom a temple and a tower; both structures figure prominently in the story of the Sword Lake Turtle. On the northernmost islet, the Tháp Rùa (Turtle Tower) was built ca. 1886 in memory, it's been said, of the Golden Turtle who guards Lê Lợi's magic sword (Cover). Today, although the tower's Gothic shell stands empty, the grassy margins of the islet provide the last remnant of marginal basking and nesting habitat for Swinhoe's softshell turtle and the lake's other turtles (Friends of Vietnam Heritage 2008).

On the southerly islet, the red Thê Húc (Rising Sun) bridge arcs across Hoàn Kiếm's waters to the Ngọc Sơn Temple (Temple of the Jade Mountain). In a side room off the main temple complex, protected inside a large glass display case, rests what some believe to be Kim Qui, the Golden Turtle (Friends of Vietnam Heritage 2008). This preserved Swinhoe's softshell turtle specimen, the male found dead along Hoàn Kiếm's shoreline in 1967 (Farkas and Webb 2003), is believed to be an apocryphal 500 years old, making it a suitable candidate for the legendary Sword Lake Turtle (Friends of Vietnam Heritage 2008).

In the six-hundred years since the Dragon King first guided the farmer king to victory, the legend of the Sword Lake Turtle has evolved in the telling. The heart of this legend roughly holds true to the historical record. Between 1418 and 1426, after enduring years of violent occupation under an invading force of the Chinese Ming, the farmer Lê Lợi raised an army of 500 volunteer soldiers – the Lam Son army – to free their country. Although Lê Lợi's guerilla tactics demoralized and chipped away at the invader's forces, the Ming occupation persisted (Trang 2006). It is here that the lines between legend and history blur.

As retold by Minh Trang in "Sự Tích Hồ Gươm (The Legend of Sword Lake)" (Trang 2006; see also Asian Turtle Conservation Network 2008), legend has it the Dragon King – witnessing from his underwater palace the Lam Son army's struggle – sent forth the Golden Turtle (referred to as the "Golden Tortoise" in Trang 2006) to deliver



**FIGURE 1.** Shortly after a second wild *Rafetus swinhoei* was discovered in April 2008 in Đồng Mô Lake, the turtle disappeared after floods washed out Đồng Mô's dam. A local fisherman later announced he had caught the turtle (pictured here), leading to an argument before the fisherman relented and released the turtle to officials who returned it to the lake. Courtesy Asian Turtle Conservation Network. Photographer Tim McCormack.

a magical sword blade to Lê Lợi. Whether by design or by accident (here the legend is unclear on all counts), this blade was delivered, not to Lê Lợi, but to a fisherman, Lê Thận. Lê Thận cast his net three times, each time entangling it in the sword blade. It wasn't until the third cast that Lê Thận, beguiled by the reappearing blade, tucked it in his belt and returned home. Soon thereafter, Lê Thận joined Lê Lợi's resistance army.

One night, after stopping by Lê Thận's quarters to visit, Lê Lợi noticed the blade on the wall, which began to glow in his presence. Inspecting the blade, Lê Lợi saw the radiance emanated from two words etched on the blade: "Thuận Thiên" ("Heaven Approves" or "The Will of Heaven"). Several days later, during a retreat of Lê Lợi's guerilla army before an anticipated Ming attack, the farmer king again saw a strange glow – this time from the canopy of an ancient banyan tree. Upon closer inspection, Lê Lợi saw that it was a sword hilt decorated in gems and etched with the same divine words: "Thuận Thiên."

When Lê Lợi and Lê Thận next crossed paths, Lê Lợi asked to see the blade; the blade and hilt were a perfect fit. Seeing this as a sign from heaven, Lê Thận knelt before Lê Lợi, bestowed

him the sword, and swore his allegiance to the farmer king that he might save their people and their homeland (Trang 2006).

As word of Lê Lợi's magical sword spread, his Lam Son army grew (Trang 2006, Friends of Vietnam Heritage 2008). Backed by a growing resistance some 350,000 soldiers strong, reinforced with horses and elephants, and – by legend's score – armed with the magical sword that made Lê Lợi grow tall and gave him the strength of many men (Friends of Vietnam Heritage 2008), Lê Lợi destroyed the Ming forces and led his people to victory. After years of oppression, in 1427 the Chinese recognized the Vietnamese people's independence. One year later, Lê Lợi was declared king under the title Lê Thái Tổ, founder of the Lê Dynasty (Friends of Vietnam Heritage 2008).

Not long after Lê Lợi became king, he was touring Lục Thủy ("Green Water") Lake when the Golden Turtle emerged from the waters to retrieve the divine sword. By some accounts, the Golden Turtle asked for the sword's return and Lê Lợi respectfully complied (Trang 2006); by others the messenger instead plucked it from Lê Lợi's belt, inciting the king to retrieve it (Friends of Vietnam Heritage 2008). In the end, however, Lê Lợi acknowledged the sword's return to the Dragon King and in tribute, renamed the waters Hồ Hoàn Kiếm, "The Lake of the Returned Sword" (Trang 2006, Friends of Vietnam Heritage 2008).

Naturally, the rarity of the Sword Lake Turtle and its legendary, divine origin have led many people to treat Swinhoe's softshell turtle among the ranks of such cryptid 'species' as the Loch Ness Monster (Loch Ness, Scotland), El Chupacabra (North/South America), and Bigfoot (aka Sasquatch; Pacific Northwest, North America), the darlings of cryptozoology. As might be expected, the legend has become common fodder for cryptozoology articles, guides, and encyclopedias alike (Coleman 1999, Heinselman 2000). Take for example *The Field Guide to Lake Monsters, Sea Serpents, and Other Mystery Denizens of the Deep*, which refers to the Sword Lake

Turtle as a "Cryptid Chelonian... one of the legendary Vietnamese turtles that are said to inhabit [Hoan Kiem Lake]" (Coleman and Huyghe 2003, p. 181). Even these guides, which trade in rumor, hoax, and speculation, have come to admit nonetheless that the Sword Lake Turtle has transcended the realm of mystery: "The turtles are seen so rarely that many locals still consider them legend rather than reality, though reality seems to be getting the edge of late" (Coleman and Huyghe 2003, p. 182).

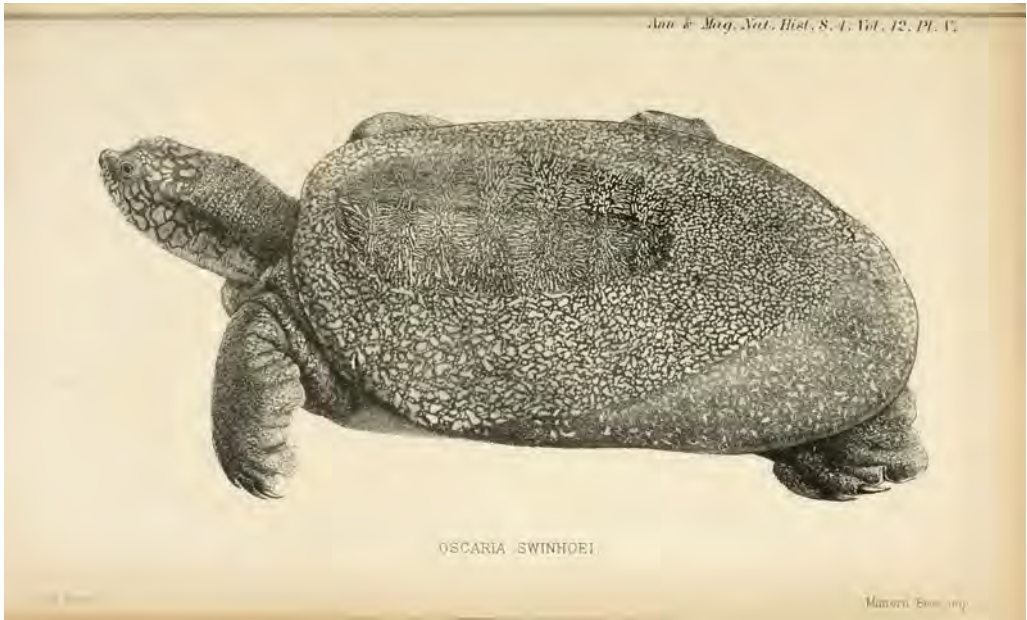
A parallel can be drawn between the legend of the Sword Lake Turtle and the Arthurian legend. Magical swords (Lê Lợi's divine blade and King Arthur Pendragon's Excalibur) bestowed and returned to watery origins (the Golden Turtle of Lục Thủy and The Lady of the Lake) feature prominently in both legends. The fundamental difference is that through the Swinhoei's softshell turtle, the Golden Turtle has transcended legend in its own right.

Real though it is, embarrassingly little is known about Swinhoe's softshell turtle. This may be in no small part a result of the taxonomic confusion surrounding the species itself. Over the years, Swinhoe's softshell (also soft-shelled) turtle – also known familiarly as the Shanghai softshell turtle, giant Yangtze turtle, Red River giant softshell turtle, and bicallosite softshell turtle – has been erroneously described under as many as sixteen synonyms.

In 1873, in a note prepared for *The Annals and Magazine of Natural History*, British Museum (Natural History) zoologist John Edward Gray described Swinhoe's softshell turtle for the first time under the name *Oscaria Swinhoei* [*sic*] accompanied by a single black and white illustration (Figure 2; Gray 1873). The *O. swinhoei* holotype specimen Gray designated had been sent by its collector, English naturalist and Consul Robert Swinhoe (Farkas and Fritz 1998), as part of a larger collection of "Mud-Tortoises" collected "from the neighbourhood [*sic*] of Shanghai [China]" preserved in spirits (Gray 1873, p. 156). Gray described the holotype to be "a large specimen of the most beautiful species of



## SWINHOE'S SOFTSHELL TURTLE (*RAFETUS SWINHOEI*)



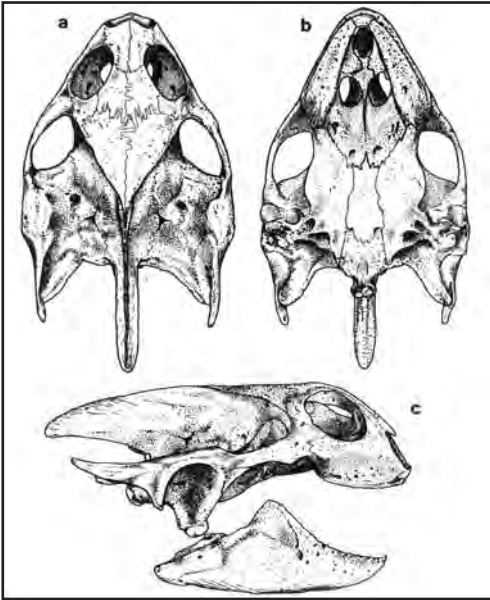
**FIGURE 2.** In 1873, zoologist John Edward Gray described *Rafetus swinhoei* for the first time under the synonym *Oscaria swinhoei* from a holotype specimen sent to him by English naturalist Robert Swinhoe. Gray's general description of the specimen included a single black and white illustration, figured here. From John Edward Gray, "Notes on Chinese Mud-Tortoises (Trionychidae), with the Description of a New Species Sent to the British Museum by Mr. Swinhoe, and Observations on the Male Organ of this Family," *The Annals and Magazine of Natural History, Including Zoology, Botany, and Geology* (1873). Series 4(12): 156-161, plate V.

Mud-Tortoise which I have yet observed from any country" and, he concluded, "I believe it to be new to science" (Gray 1873, p. 156). Gray noted that this specimen represented "the most beautiful species of Trionychidae that has yet occurred, and most distinct by its beautiful coloration," explaining that "the lines on the back have some resemblance to Chinese printing" (Gray 1873, p. 158). The skull of Gray's type specimen was extracted and individually labeled in 1947 (BMNH 19473.6.13) separate from the specimen's remaining soft tissue and skeletal material (BMNH 1946.1.22.9) preserved in alcohol (Farkas and Fritz 1998). The skull was later illustrated by Uwe Fritz (Figure 3; Farkas and Fritz 1998).

In the late 1880s through the early 1900s, the Swinhoe's softshell turtle underwent the throes of what would become the first of two waves of nomenclatural revisions. In 1880 it was re-described by French Jesuit missionary and zoolo-

gist Pierre Marie Heude. Heude was a renowned 'splitter' of species, a quirk he confirmed by grouping the specimens in his new *Yuen* genus (Heude 1880) based on "subtle colouration features (e.g. spot size, shape and tone, and the presence or absence of 'clouding' on the plastron)" (Farkas and Fritz 1998, p. 68). When all was said and done, Heude's *Yuen* – based on the Chinese character "yuán", translated by Heude as "grand grenouille," or great frog (Heude 1880, p. 20) – comprised five new species: *Y. maculatus*, *Y. leprosus*, *Y. elegans*, *Y. viridis*, and *Y. pallens* (Heude 1880).

In 1889 British Museum (Natural History) zoologist George Albert Boulenger synonymized Heude's myriad species under *Trionyx swinhonis* (Boulenger 1889); Farkas and Fritz (1998) later called Boulenger's *swinhoei*-to-*swinhonis* switch "an unjustified emendation". Then, in 1893 osteologist and testudinologist Georg Herman Carl Ludwig Baur, an associate paleontol-



**FIGURE 3.** In 1947, the skull of Gray's 1873 "mud-tortoise" holotype, *Oscaria swinhoei*, was extracted and separately labeled. The skull was later examined and illustrated by Dr. Uwe Fritz and colleague Balazs Farakas in 1998 as part of a study to review and confirm the allocation of *swinhoei* under the genus *Rafetus*. Courtesy Dr. Uwe Fritz; from Balazs Farakas and Uwe Fritz, "On the Identity of *Rafetus swinhoei* (Gray, 1873) and *Pelochelys maculatus* (Heude, 1880) (Reptilia: Testudines: Trionychidae)," *Zoologische Abhandlungen, Staatliches Museum für Tierkunde Dresden* (1998), 50(5): 59-75.

ogy professor at the University of Chicago, reorganized the genera of the Trionychidae. In doing so, he described the Swinhoe's softshell turtle as *Pelodiscus swinhoei* (Baur 1893). It wasn't until 1902 that Austrian herpetologist Friedrich Siebenrock (1902, unavailable for review; see Meylan and Webb 1988) revived *Trionyx swinhoei*, reuniting Gray's *Swinhoei* taxon under the *Trionyx* genus (Meylan and Webb 1988).

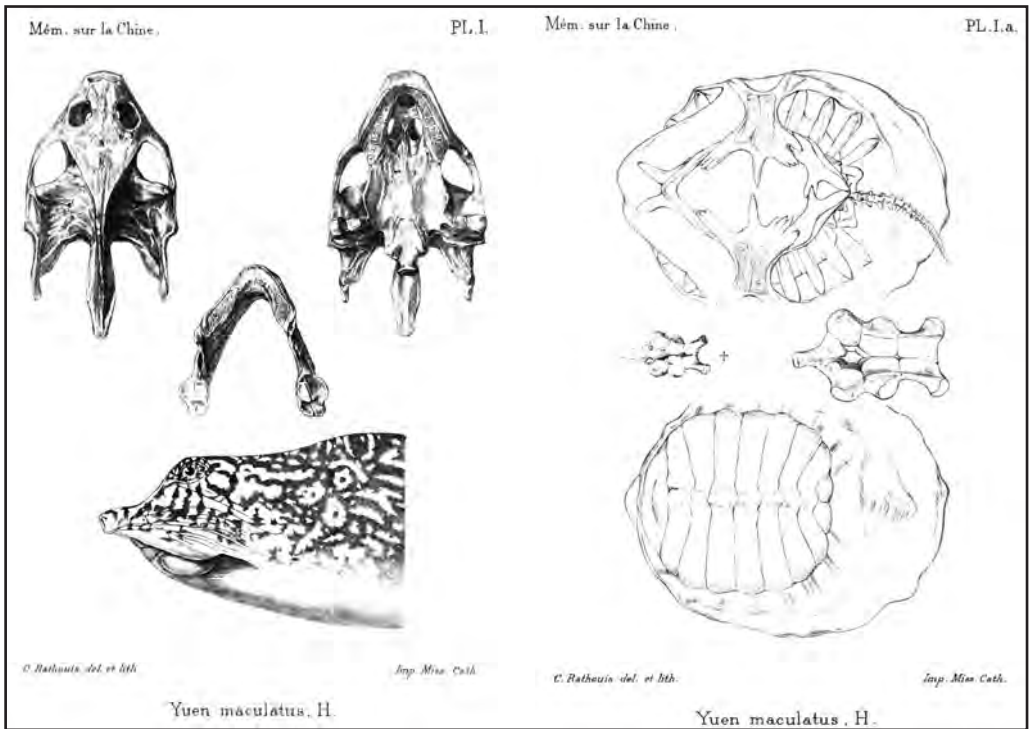
For most of the 20<sup>th</sup> Century there was scarce mention of Swinhoe's softshell turtles, with one notable exception. In 1935, American Museum of Natural History assistant curator Clifford H. Pope published *The Reptiles of China* (*Turtles, Crocodilians, Snakes, Lizards*), in which he synonymized the Swinhoe's softshell turtle,

until then still recognized as *Trionyx swinhoei*, under the Chinese softshell turtle, *Pelodiscus sinensis* (formerly, *Trionyx* (= *Amyda*) *sinensis*; Pope 1935). Although later authors recognized this error (see discussion by Meylan and Webb 1988), it wasn't until 1987 that Peter Andre Meylan with the American Museum of Natural History proposed the binomen *Rafetus swinhoei* (Meylan 1987), divesting this unique species from any association with *Pelodiscus sinensis* through a reexamination of Heude's 1880 species descriptions and illustrations (Meylan and Webb 1988).

Earlier, M. Zhang (1984, unavailable for review; see Farkas and Fritz 1998) had described the new species *Pelochelys taihuensis* based on subfossil skull fragments and a pleural bone, a stuffed specimen, a skeletonized specimen, and two live specimens collected from Zhejiang province (and questionably Jiangsu province). Zhang (1984) reported that this species was called by locals the rash-headed turtle, a reference that corresponds neatly with the yellow face markings of the Swinhoe's softshell turtle (Farkas and Fritz 1998). Shortly thereafter, Hsi-Jen Tao (1986, unavailable for review; see Farkas 1992) described a second fossil specimen as *Trionyx liupani*, followed in 1997 by K. -T. Zhao (1997, unavailable for review; see Farkas and Fritz 1998), who described five softshell turtle species in China, among them *Pelochelys maculatus* and *Rafetus swinhoei*.

The following year, Farkas and Fritz (1998) responded with a review of Zhang's *Pelochelys taihuensis*, Tao's *Trionyx liupani*, and Zhao's *Pelochelys maculatus* and *Rafetus swinhoei* specimens against Gray's *Oscaria swinhoei* and Heude's *Yuen maculatus*, re-confirming the validity of *Rafetus swinhoei* as the proper binomial in the process of sorting out the various species.

Because Heude's type specimens were lost in passing years, Farkas and Fritz first compared Heude's illustrated plates depicting the head and skull and skeletal material of his *Y. maculatus* (Figure 4) and the skeletal material of both his *Y. maculatus* and *Y. elegans* with the type of Gray's



**FIGURE 4.** In 1880, French Jesuit missionary and zoologist Pierre Marie Heude described the Swinhoe's softshell turtle under the genus *Yuen* as one of five different species. Two plates accompanying Heude's description of *Yuen maculatus*, pictured here (Pl. I and Pl. I.a), illustrate the head of an intact specimen, as well as details of the skull, carapace, and plastron. From Pierre Marie Heude, "Mémoire sur les Trionyx," Mémoires concernant l'Histoire naturelle de l'Empire Chinois par des Pères de la Compagnie de Jésus. Mission Catholique, Shanghai (1880), plate 1 and 1a.

*O. swinhoei*. Their comparison left little doubt that both *Y. maculatus* and *Y. elegans* represented a single taxon, *Y. maculatus*, and that there was not enough distinction between Heude's remaining *Yuen* taxa to generically distinguish them from *maculatus*. Given the osteological similarities of the specimens and their shared geographic origins, the minor color variations were not deemed significant enough to warrant specific distinction and *O. swinhoei* and *Y. maculatus* were considered synonymous (Farkas and Fritz 1998).

Upon closer examination *Pelochelys taihuensis* (Zhang 1984) and *Trionyx liupani* (Tao 1986) were also subsequently synonymized with *Rafetus swinhoei* (Farkas 1992, Farkas and Fritz 1998). Similarly, Zhao's descriptions of *Pelochelys maculatus* and *Rafetus swinhoei* speci-

mens were found to be inadvertently based on several misidentifications; the *Rafetus swinhoei* specimens actually represented the Asiatic softshell turtle (*Amyda cartilaginea*), and the *Pelochelys maculatus* specimens were in fact *Rafetus swinhoei* (Farkas and Fritz 1998, B. Farkas, pers. comm.).

In the spring of 2000, Vietnam National University of Hanoi biology professor Hà Đình Đức formally described the turtle of Hanoi's Hoàn Kiếm Lake as yet another unique species, *Rafetus leloi* (Đức 2000a,b, unavailable for review; see Pritchard 2001, Farkas and Webb 2003, Overland 2005), a tribute to Emperor Lê Lợi and Kim Qui, the legendary Golden Turtle. A second formal description – *Pelochelys hoguomensis* – was proposed in December 2000 by the anonymous 'S.A.' (1999, unavailable for

review; see Farkas and Webb 2003). Both accounts were published in local Hanoi newspapers, a non-traditional yet seemingly satisfactory means of meeting The Code of the International Commission on Zoological Nomenclature (Farkas and Webb 2003) under Article 8.1.1., which states that published work “must be issued for the purpose of providing a public and permanent scientific record” (ICZN 2000).

Hà Đình Dúc (2000b) designated three type specimens for *Rafetus leloii*: the holotype (RHK 01-1967), found dead along the shoreline of Hoàn Kiếm Lake in 1967; the allotype (RHK 02-1968), comprised of the misassembled skeleton of a large female from Hoàn Kiếm Lake (presumably collected in 1968); and the paratype (RHK 03-1993), a stuffed specimen collected from Quỳnh Lâm Swamp near the town of Hòa Bình. Hà Đình Dúc (2000b) proposed that the immense size of these three types (and several ancillary, subjective characteristics) justified their designation as a new species. However, after a thorough review of the *leloii* types and descriptions, Farkas and Webb (2003) concluded that any differences were not conclusive enough to warrant taxonomic recognition.

More recently, Le et al. (2010) proposed the new species *Rafetus vietnamensis* based on a comparative morphological and DNA analysis of specimens. Farkas et al. (2011) again concluded that since this newest diagnosis differed little from that proposed earlier for *Rafetus leloii* (Hà Đình Dúc 2000b), both diagnoses represented the same biological entity and were therefore invalid (Farkas et al. 2011).

*Rafetus swinhoei* stands as the currently accepted binomen for Swinhoe’s softshell turtle. This synonymy has since been recognized as valid by the CITES Nomenclatural Committee (Fritz and Havas 2006) and the Turtle Taxonomy Working Group (2007) and continues to be upheld today.

The taxonomic confusion between Swinhoe’s softshell turtle and other sympatric softshell turtle species is not surprising. In the family Trionychidae alone, there are approximately 25 soft-

shell turtle species. Swinhoe’s softshell turtle is one of only two bicallosite softshell turtles in the genus *Rafetus*. The second, the Euphrates softshell turtle (*R. euphraticus*), is restricted to the Tigris and Euphrates river drainages in southern Turkey, Syria, Iraq, and Iran, as well as north-eastern Israel (Pritchard 2001). The genetic variability between these disjunct species suggests these taxa may have been isolated for 50-55 million years (Le and Pritchard 2009).

Although sympatry is relatively uncommon among the Trionychidae, the range of Swinhoe’s softshell turtle nevertheless overlaps with several softshell species (i.e. *Palea steindachneri*, *Pelodiscus sinensis*, *Amyda cartilaginea*, and *Pelochelys cantorii*). But as trionychid species mature, the color markings and other external distinguishing characters clearly evident in juvenile specimens become increasingly nondescript, making it difficult to accurately distinguish species in adult specimens (Pritchard 2001).

Before they fade with age, the markings of Swinhoe’s softshell turtle are indeed unique: Remember that Gray originally described the type before him as “the most beautiful species of Trionychidae that has yet occurred,” one “most distinct by its beautiful coloration” with markings that reminded him of Chinese script (Gray 1873, p. 158). In general, Swinhoe’s softshell turtle’s olive green carapace is maculated with yellow spots interspersed with more intricate yellow dots, the latter occasionally encircling the larger spots or manifesting instead in stripes, especially along the anterior margins of the shell. This pattern of large yellow spots repeats itself along the head, neck, and chin, and the extremities are olive-to-black in color dorsally but yield to yellow on the ventral surface (Gray 1873, Ernst and Barbour 1989, Ernst et al. 1997). The plastron is otherwise gray, marked with two poorly developed bony callosities on the hyoplastron and hypoplastron (Gray 1873, Ernst and Barbour 1989, Ernst et al. 1997, Wyneken et al. 2007). Several additional plastral characteristics help distinguish this species from heterospecifics (see Ernst et al. 1997 for specifics).



Meylan (1987) conjectured that the Swinhoe's softshell turtle was the second largest trionychid based on an extrapolation of length using the proportions of Heude's (1880) *Yuen maculatus* illustration, Plate 1a (Figure 4). Pritchard (2001) later ranked it among the giant trionychid species, noting that the largest representative Swinhoe's softshell turtle specimen alive at that time was the since-deceased male at the Shanghai Zoo with a maximum leathery carapace length of 1,041 mm. Still, the Swinhoe's softshell turtle remains subordinate in overall size to the *Pelochelys* and *Chitra* trionychids.

The little else that is known about this species stems from the growing body of observational data trickling out of an ongoing captive breeding program at Suzhou Zoo (Kuchling and Shunqing 2007, Kuchling 2008); the field enquiries and interviews of Vietnamese fisherman and traders by herpetologist Dr. Peter Pritchard (2001, 2005); and the motley assortment of (mostly mislabeled) museum specimens.

The known historical range of Swinhoe's softshell turtle lies within the Sông Hồng (Red River) drainage in eastern China and northern Vietnam; the lower Yangtze (Yangtze River) drainage in eastern China; and the Sông Mã (Ma River) drainage in northern Vietnam (Figure 5). The Sông Hồng originates in China's southern Yunnan province, flowing in a southeasterly direction until it crosses the border into northern Vietnam's lowlands. There, its eponymous silt-laden waters spread out into the Sông Hồng Delta, where the drainage is prone to seasonal flooding. Both Hoàn Kiếm's Sword Lake Turtle and the Đồng Mô Lake turtle fall within the Sông Hồng drainage, as do two additional preserved specimens. The first of those is from Shanghai Zoo originating in Gejiu, Yunnan province in eastern China, the second from the Vienna Naturhistorisches Museum, collected or obtained in Hanoi (Farkas 1992, Pritchard 2001). The lower Yangtze drainage in eastern China is the origin of the 400-year-old Western Garden Buddhist temple turtle that died in 2007 and the surviving male at the Suzhou Zoo (Kuchling and Shunqing 2007), as well as the type specimens designated by Gray

(1873) and Heude (1880). Gray's *Oscaria swinhoei* type was collected in "the neighborhood of Shanghai" (Gray 1873, p. 156), while Heude's *Yuen* types were collected in the Huángpǔ River near Shanghai and at Tàì Hú Lake near Suzhou, Jiangsu province (Heude 1880).

Although it is unclear how widespread the historical range of Swinhoe's softshell turtle may have been, the evidence linking the Middle Eastern/East Asian *Rafetus* and North American *Apalone* genera as sister taxa (Engstrom et al. 2004) hints that *Rafetus*' distribution may once have been more extensive than its present range. At present, it is suspected that the Swinhoe's softshell turtle is now extirpated from the polluted waters of Tàì Hú Lake, and thus all Chinese waters, and has become threatened in Vietnam throughout the Sông Hồng drainage due to over-fishing, pollution, and dams. Nonetheless, the present-day range of the Swinhoe's softshell turtle appears to be restricted for the most part to northern Vietnam within the Sông Hồng drainage (Pritchard 2005).

For several years, Dr. Peter Pritchard of the Chelonian Research Institute has been actively involved in investigating alleged Swinhoe's softshell turtle sightings through field surveys and *in situ* interviews in eastern China and northern Vietnam (Pritchard 2001, Pritchard 2005). In that time, Pritchard recorded multiple anecdotal accounts describing the capture of Swinhoe's softshell turtles by local fisherman and traders, many of which Pritchard confirmed based on skeletal remains kept as trophies or for purported Chinese medicines. Among the recent locations along the Sông Hồng drainage where Swinhoe's softshell turtles have been reported in Vietnam are Hòa Bình, Hòa Bình province; Thái Bình, Thái Bình province; Ao Chau Swamp, Ao Chau Lake, and Dam Ben, Phú Thọ province; Sen Lake, Thanh Hoá province; and Minh Guan Commune, Yên Bái province (Pritchard 2001, Pritchard 2005).

Outside of the limits of the Sông Hồng drainage, Pritchard inspected four Swinhoe's softshell turtle skulls taken from within the Sông Mã drain-



**FIGURE 5.** The historical range of Swinhoe's softshell turtle includes the Sông Hồng (Red River) drainage in eastern China and northern Vietnam; the lower Yangtze (Yangtze River) drainage in eastern China; and the Sông Mã (Ma River) drainage in northern Vietnam.

age by a fisherman from Quảng Phú Commune, Thanh Hoá province. Those four Sông Mã turtles represent the only known outliers (Pritchard 2005).

Perhaps the most encouraging of Pritchard's findings is the confirmation of a juvenile specimen caught by fisherman around 1999 in the vicinity of the Sông Hồng in a pond at Dam Ben, Phú Thọ province. This record, combined with the previous occasion in 1995 when another juvenile was confiscated dead from a railway passenger at the Hanoi Railway Station, confirm that pairs in the wild have successfully reproduced in recent years (Pritchard 2001, Pritchard 2005).

As of 2009, at least 22 preserved Swinhoe's softshell turtle specimens are known to be catalogued in institutions and private collections to compliment Gray's 1873 type (1 specimen, BMNH 1946.1.22.9 and BMNH 1947.3.6.13; Pritchard 2001, Le and Pritchard 2009). This

ancillary list includes both skeletal remains such as those Pritchard recovered during his field surveys and more formal specimens like those from the Berlin Zoo (1 specimen, ZMB 36437 and 36438), Naturhistorisches Museum, Vienna (1 specimen, NMW 30911; Figure 6), Shanghai Natural History Museum (5 specimens, 2 of these mislabeled '*P. bibroni*'), Zhe Jiang Provincial Museum (1 specimen mislabeled *Pelochelys cantorii*, 54001), Ngọc Sơn Temple (1 mounted specimen on display, Hà Đình Đức's *leloii* holotype, RHK 01-1967), Hanoi Museum (1 specimen, misassembled, Hà Đình Đức's *leloii* allotype, RHK 02-1968), Hòa Bình municipal museum (1 specimen, Hà Đình Đức's *leloii* paratype, RHK 03-1993), and University of Hanoi (1 specimen, T91; Pritchard 2001, Pritchard 2005, Le and Pritchard 2009). Heude's 1880 *Yuen* types are considered lost (Meylan and Webb 1988, Pritchard 2001).

Pritchard's *in situ* field surveys and interviews with veteran fisherman and traders also pro-

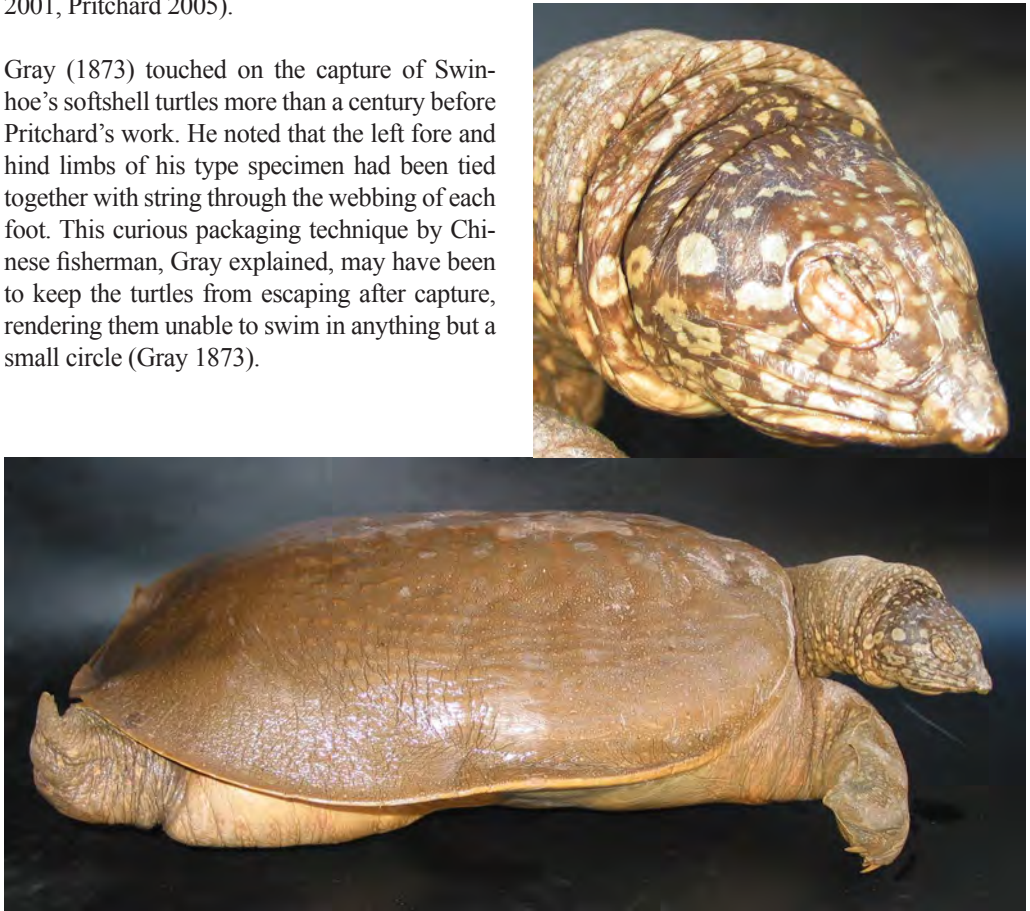
## SWINHOE'S SOFTSHELL TURTLE (*RAFETUS SWINHOEI*)

vide a rare glimpse into the pursuit of softshell turtles for food over the last century, one of the suspected reasons for its near-extinction today. Although Heude (1880) observed more than a century ago that adult Swinhoe's softshell turtle were too dangerous and difficult to catch to warrant a directed fishery, contemporary Vietnamese fisherman demonstrated for Pritchard the use of firearms and machetes to catch what they called the *Con gai* or *Conh Chanh*. One unique technique included catching them with baited hooks, stranding them on sunken bamboo vessels, and then raising the vessel to transport their catch. Another involved puncturing their leathery carapace with a hooked pole, dragging them backwards by hand or buffalo, and then upending them with a sharp twist of the pole (Pritchard 2001, Pritchard 2005).

Gray (1873) touched on the capture of Swinhoe's softshell turtles more than a century before Pritchard's work. He noted that the left fore and hind limbs of his type specimen had been tied together with string through the webbing of each foot. This curious packaging technique by Chinese fisherman, Gray explained, may have been to keep the turtles from escaping after capture, rendering them unable to swim in anything but a small circle (Gray 1873).

Little did Gray know that his aside would become a modern metaphor in the years to come for the turtle's very existence: an incipient captive breeding program with too-few females; a species circling the drain toward extinction.

After China Girl was discovered in 2007 at the Changsha Zoo, stakeholders acted quickly to initiate the captive breeding program. But neither the Suzhou or Changsha zoos nor the West Garden Buddhist temple were eager to volunteer their turtles for a captive breeding loan. Instead, after the West Garden Buddhist temple's last remaining male died in August 2007, WCS-China and the two Chinese zoos signed an agreement



**FIGURE 6.** Profile and close-up of preserved *R. swinhoei* specimen (NHMW 30911) from the collection of the Museum of Natural History, Vienna, collected in the vicinity of Hanoi, Vietnam. Courtesy Richard Gemel, Museum of Natural History Vienna.

to proceed with the breeding program via artificial insemination. Artificial insemination was not without its own risks, especially considering the age of Suzhou's male, thought to be well over 100 years old. But the potential merits of a breeding loan were overshadowed by memories of the bloody encounter between the two male Swinhoe's softshell turtles at Suzhou Zoo. In late December, in the 11<sup>th</sup> hour of a WCS-China-sponsored captive breeding workshop, the International Union for Conservation of Nature's Turtle Survival Alliance task force turned the tide by offering to retrofit the Suzhou enclosure, pay China Girl's transportation costs, and secure an insurance policy (Kuchling and Shunqing 2007, Kuchling 2008).

The following spring, China Girl emerged from hibernation as usual. On May 5, 2008, the captive breeding team confirmed she was in a pre-ovulatory state before placing her in a foam-padded wood box to make the 600-mile, 14-hour drive from Changsha to Suzhou. Upon her arrival in Suzhou the following morning, the team released her into one half of the newly-modified breeding pond. China Girl acclimated to her new surroundings quickly. The next day, the Suzhou male was given access to the adjoining half of the enclosure where, separated only by a dividing fence, the two inspected each other without any signs of aggression. The divider was removed on May 8 and the pair was quick to get acquainted, showing a mutual interest that quickly led to courtship and mating over the next week (Figure 7). Concerned for their health, on May 19 the captive breeding team separated the pair before they killed each other (Kuchling 2008).

In years past, China Girl had deposited her eggs in the water of her large outdoor pond at the Changsha Zoo. But on June 6<sup>th</sup>, she scaled the sandy Suzhou beach, excavated a nest, and deposited 45 eggs. The captive breeding team uncovered the eggs June 23<sup>rd</sup> and – although several were thin or cracked – moved 32 to incubators, leaving 13 in the nest chamber to incubate naturally. Within days, the eggs began showing signs of growth and development (Kuchling 2008). But to everyone's dismay, the eggs did

not hatch, nor did a second clutch of 60 eggs deposited later that year (Kuchling and Shunqing 2009, G. Kuchling, pers. comm.).

Those 105 eggs encouraged the captive breeding team to give the pair a second chance, and in 2009 the pair was reunited. As before, they courted and mated in short order and, as the summer played out, China Girl retreated to the beach not twice but four times, laying more than 200 eggs in four clutches. But by summer's end, not a single egg had hatched (Kuchling and Shunqing 2009, G. Kuchling, pers. comm.).

At first, the captive breeding team suspected these failures may be connected to the pair's diet, corroborated by the fragile state of several eggshells when they were first uncovered (Anna 2008, Yardley 2008, Kuchling and Shunqing 2009, Kuchling et al. 2010). A glass barrier was installed in 2009 to prevent zoo visitors from throwing "junk food" and other garbage into the smaller of the turtle's two breeding ponds, helping give Suzhou Zoo more control regulating the diet of the turtles (G. Kuchling, pers. comm., Kuchling et al. 2010): whole shrimp, freshwater crayfish, fishes, freshwater snails, frogs, quail, pigeons, and other dietary supplements (Kuchling et al. 2010).

The captive breeding team also began investigating the possibility that the failed fertilizations might be linked to the male's old age. Given the current understanding that male Swinhoe's softshell turtles undergo spermatogenesis in the summer (June to September) and are able to copulate from October into the spring of the following year, the captive breeding team hypothesized there may some risk involved in relying on the aged male to store its sperm for more than six months before pairing the turtles in the short window available following their emergence from hibernation (Turtle Survival Alliance 2010).

In the fall of 2009, the captive breeding team attempted to let the pair overwinter together in the smaller, protected breeding pond. As could be expected, by late September the male initiated





**FIGURE 7.** In the spring of 2008, the Suzhou Zoo admitted China Girl (submerged) – then the only known living female Swinhoe's softshell turtle in existence – into a newly constructed breeding pond as part of the first attempt to breed this rare species. The Suzhou Zoo's male (basking) had a previous history of violence the last time a fellow male Swinhoe's softshell turtle was introduced into its pond. In 2008, 2009, 2010, and 2011 the much-awaited courtships between China Girl and the Suzhou Zoo's male resulted in several hundred eggs, none of which survived. Courtesy Dr. Gerald Kuchling of the University of Western Australia.

mating behavior, but the pair was quickly separated after China Girl began presenting scars from the male's attempts to restrain her through biting. Due to the incessant cold and rain in the spring of 2010, China Girl held off nesting until mid-June. Three clutches were laid that summer: 63 eggs on June 16<sup>th</sup>, another 63 eggs on July 2<sup>nd</sup>, and an unknown number of eggs on July 17<sup>th</sup>. Only 2 to 3 eggs of each of the first two clutches candled showed signs of fertilization (the third clutch was left undisturbed). Again, none of the eggs hatched (Turtle Survival Alliance 2010).

With China Girl's safety in mind, in July 2010 a glass barrier was installed around the larger breeding pond to allow the pair to stay together through the fall and winter months, to allow the male to inseminate China Girl with fresh sperm, to allow China Girl (rather than the male) to store the sperm, and to help China Girl avoid being cornered and bitten by the male in their

larger, protected enclosure (Turtle Survival Alliance 2010).

Nevertheless, the 2011 breeding season proved equally disappointing. Between the three clutches laid that year – 51 eggs on June 7<sup>th</sup>, 67 eggs on June 27<sup>th</sup>, 70 eggs on July 10<sup>th</sup> – all 188 eggs appear to have been infertile (Turtle Survival Alliance 2011).

Despite such setbacks, stakeholders are not without hope. In Vietnam, following reports that the Sword Lake Turtle had developed lesions and other signs of injury in 2011, a rescue effort was initiated that spring to capture and treat the lone turtle in Hoàn Kiếm Lake. After Hanoi officials and scientists sanctioned a rescue attempt to capture the Sword Lake Turtle, on March 8<sup>th</sup> teams of divers and other rescuers armed with small boats were thwarted after the turtle escaped their nets. But in a second attempt

on April 3<sup>rd</sup>, 2011, rescuers successfully netted the Sword Lake Turtle, which was transferred to a make-shift hospital on Tháp Rùa island in the heart of Hoàn Kiếm Lake for medical treatment (Mason 2011). During its temporary captivity, the Sword Lake Turtle – confirmed to be a female – was treated for her injuries before being released back into Hoàn Kiếm Lake on July 12<sup>th</sup>, 2011 (Asian Turtle Program 2011).

Six-hundred years ago, the Golden Turtle messenger Kim Qui delivered the Vietnamese people from destruction. Now, only time will tell if the people of Vietnam – together with their Chinese brethren and the international herpetological community – can return the favor. The future of the Swinhoe's softshell turtle lies not only in China Girl's fragile eggs but in the promise that in some unexplored backwaters, Hoàn Kiếm Lake's Sword Lake Turtle and the Đồng Mô Lake turtle have distant company in the way of wild strays that will find each other and spawn a new generation of turtles before time runs out.

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# History and Evolution of the Boy Scouts of America Reptile Study Merit Badge Pamphlet

John Moriarty

3261 Victoria Street, Shoreview, MN 55126, USA, [frogs@umn.edu](mailto:frogs@umn.edu)

The Boy Scouts of America (BSA) began issuing merit badges in 1911 as a way for scouts to explore topics that interest them and to teach them skills needed to be a good scout (Ratcliffe 1998). In 1927, the Reptile Study merit badge was added to the list of available merit badges, and was the first badge dedicated to the study of herpetology. The actual badge earned by the scouts depicted the head of an unidentified venomous snake. Illustrations of the badges can be seen on the covers of many of the pamphlets (Figure 1.) The Reptile Study badge was in use for 66 years until it was replaced in 1993 by the Reptile and Amphibian Study merit badge, which is still available for scouts to earn. The Reptile and Amphibian Study badge earned by the scouts depicts an unidentified turtle and frog. A total of 418,461 Reptile Study merit badges were earned during the years that it was issued. As of 2006, 153,155 Reptile and Amphibian Study merit badges were earned ([http://meritbadge.org/wiki/index.php/Merit\\_Badges\\_Earned](http://meritbadge.org/wiki/index.php/Merit_Badges_Earned)) and continue to be earned at a rate approximately 11,000 badges each year.

The BSA began publishing merit badge pamphlets in 1915 to provide the background and requirements for earning merit badges. Most scouts who pursue a merit badge purchase the pamphlets, so large numbers of pamphlets are printed. Collectors classify the pamphlets into a series of 12 Types, each of which reflects changes in cover design and layout (Figure 1). The first *Reptile Study* merit badge pamphlet was published in conjunction with the establishment of that merit badge in 1927, and is classified as a Type 2 pamphlet (Price 1998). Four different authors prepared six independently copyrighted versions of the *Reptile Study/Reptile and Amphibian Study*

merit badge pamphlet since its first issue. More than 650,000 copies were produced in over 71 printings (Table 1; Price 1998). This makes it one of the best-selling reptile books in history.

Considering the popularity and longevity of the publication, I was surprised that I could not find any reviews of the pamphlet in any herpetological or natural history journal. The title was included in *Copeia* in 1944 in a list of new books received (Anonymous 1944), but otherwise its history remains obscure.

The early editions, published from 1927 to 1943, were authored by William Hassler from the American Museum of Natural History. Those early pamphlets outlined seven requirements to earn the merit badge. Only minor format changes and changes to the address on the cover were made between the first three printings, but the copyright date changed with each printing. In the 1930 edition, the information on snakebite was revised. The suggested use of injected permanganate was removed and replaced with a recommendation for the use of a tourniquet and antiseptics.

The editions published from 1944 to 1993 were authored by Roger Conant of the Philadelphia Zoo. In Conant's first edition the number of requirements increased from seven to ten. The original two requirements dealing with venomous snakes were combined into one requirement. New requirements included making sketches showing patterns and shapes of seven reptiles and three amphibians, describing how ten reptiles or amphibians are useful to man, outlining the number and approximate distribution of reptiles and amphibians, and keeping a reptile or amphibian alive in captivity for at least one month. Though

**TABLE 1. Printing History of *Reptile Study*/*Reptile & Amphibian Study* Merit Badge Pamphlet**

Author	Copyright	# of Printings	Numbers (1000s)	# of Cover Types	Types (see Fig. 1)
<b>Reptile Study</b>					
Hassler	1927	5	? <sup>1</sup>	2 <sup>2</sup>	2a, 2b,
Hassler	1930	21	24+	4 <sup>3</sup>	2b, 2c, 2d, 3
Conant	1944	32	253+	3	4, 5, 6a, 6b
Conant	1972	23	222+	3	6b, 7, 8
<b>Reptile and Amphibian Study</b>					
Gibbons	1993	? <sup>4</sup>	? <sup>4</sup>	1	8
Stolz	2005	? <sup>4</sup>	? <sup>4</sup>	2	8, 9

<sup>1</sup> BSA noted years with reprints, but not quantities. There were 1,000 or less per printing.

<sup>2</sup> The cover difference was a change in the address at the bottom of the cover.

<sup>3</sup> Three of the covers were similar except for a change in the address at the bottom of the cover.

<sup>4</sup> BSA no longer releases information on number of printings. It is estimated that 10,000 copies are printed each year based on past printing history and the number of merit badges earned.

the title remained *Reptile Study*, the requirements and accompanying text included information and requirements on amphibians. The number of photos was increased from 7 to 37. There are more photos of venomous snake species and fewer photos on first aid for snakebite. The length of the pamphlet increased from 45 to 63 pages.

Changes in the revised editions issued between the 1944 and 1972 included insertion of updated photos and references. The requirements stayed the same, but were arranged in a different order. The order of the chapters was changed to match the requirements. The length of the pamphlet stayed the same.

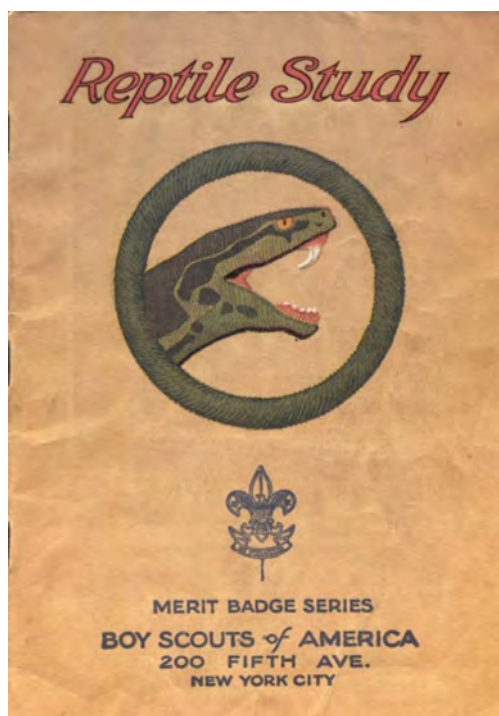
The *Reptile Study* pamphlet was mentioned in biographical accounts of Conant by Stewart and Belcher (2001) and Adler (2007). Adler (2007) stated that Conant revised the book four times but there are only two different copyrights. Two of the revisions were changes in design, but not content, so new copyright dates were not warranted.

In 1993, the *Reptile Study* merit badge was replaced by the *Reptile and Amphibian Study* merit badge. Whit Gibbons of the Savannah River Ecology Lab authored the new merit badge pamphlet. The pamphlet still listed ten requirements, but two were revised. The ‘useful species’ requirement changed from ‘useful to man’ to ‘the importance of amphibians and reptiles in

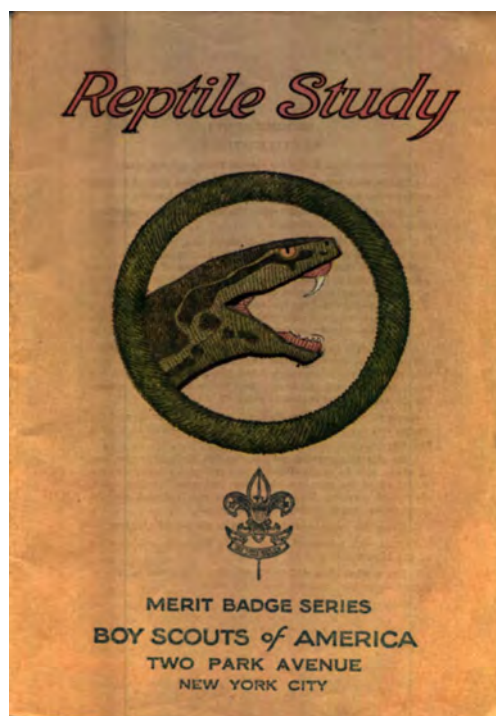
the natural environment,’ and the requirement to learn ten superstitions was changed to five superstitions and seven examples of unusual but true facts. Additions to the pamphlet included photos of non-native reptiles, and references dealing with herpetology text books, general readings, and captive care. The length increased to 80 pages.

The *Reptile and Amphibian Study* pamphlet was revised in 2005 by a new author, Gary Stolz of the US Fish and Wildlife Service. The main change in the requirements in this edition was the replacement of the requirement to keep a reptile or amphibian for one month. The requirement was replaced with an option to either keep an animal in captivity, or to make observations of a reptile or amphibian in a zoo or nature center for 30 days and to keep a journal of the observations. In recognition of the increased numbers of reptiles and amphibians being kept as pets, the text and photographs were expanded to include more non-native species. The 2008 printing was the first to be produced in full color; the layout and text were identical to the 2005 revision.

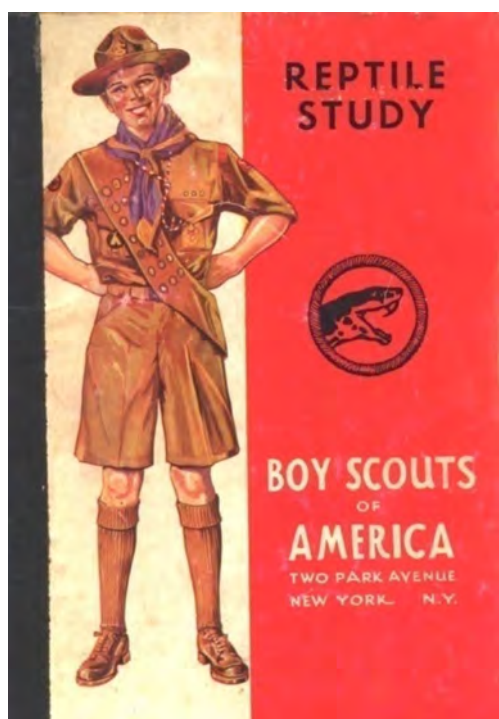
Over 70 years the merit badge requirements and the pamphlet evolved from a focus on reptiles and their danger to, or use by, man, to the importance of reptiles and amphibians in the environment. Appendix 1 lists the original and current requirements for comparison.



Type 2a - Hassler – 1927



Type 2b - Hassler – 1930



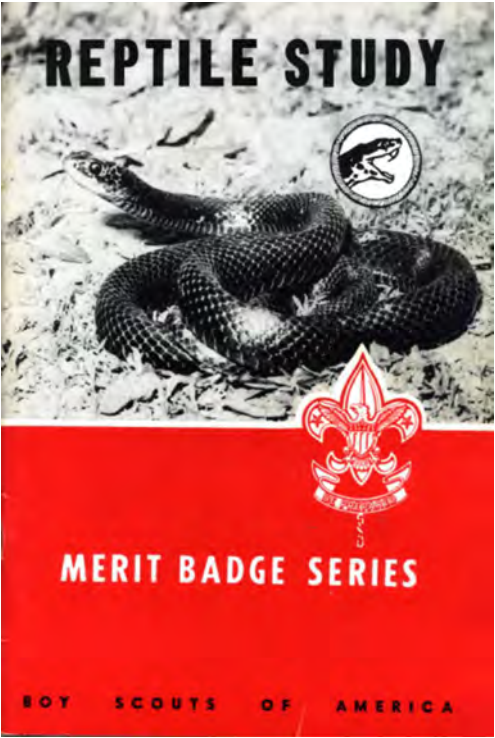
Type 3 - Hassler – 1941



Type 4 - Conant – 1944

**FIGURE 1.** Pictorial History of the *Reptile Study*/*Reptile & Amphibian Study* Merit Badge Pamphlet Covers by Type as described by Price (1998). The *Reptile Study* pamphlet starts with Type 2 because Type 1 pamphlets were used only from 1915 to 1924, prior to the first issue of *Reptile Study*. The chronological order of the types is as follows. Type 2 – 1925 to 1939 (*Reptile Study* was issued the in the third year of this type), Type 3 – 1939 to 1943, Type 4 – 1944 to 1952, Type 5 – 1953 to 1966, Type 6 – 1966 to 1971, Type 7 – 1971 to 1979, Type 8 – 1980 to 2007, Type 9 – 2008 to present.

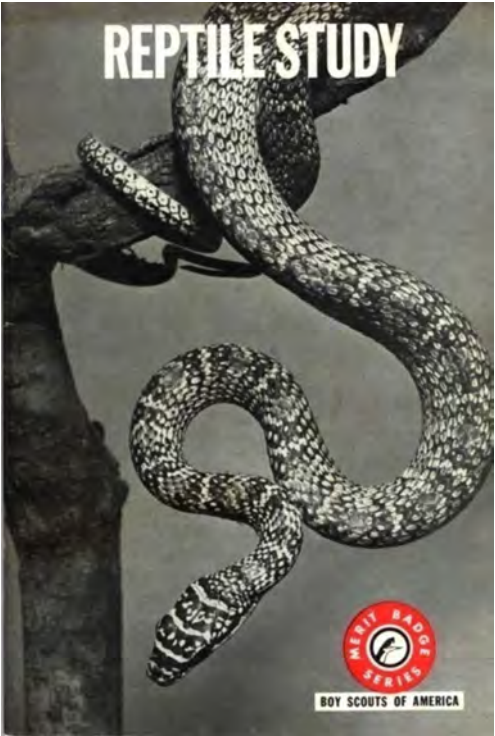




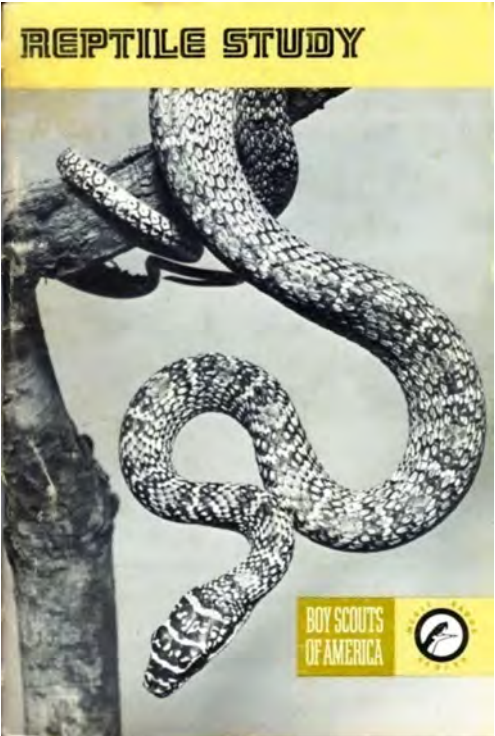
Type 5 - Conant – 1953



Type 6a - Conant – 1967



Type 6b - Conant – 1972



Type 7 - Conant – 1973

**FIGURE 1.** *Continued . . . Pictorial History of the Reptile Study/Reptile & Amphibian Study Merit Badge Pamphlet Covers by Type as described by Price (1998).*

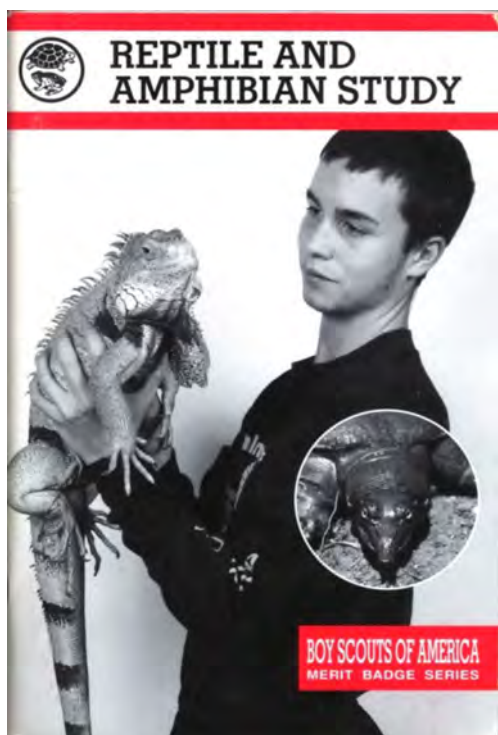




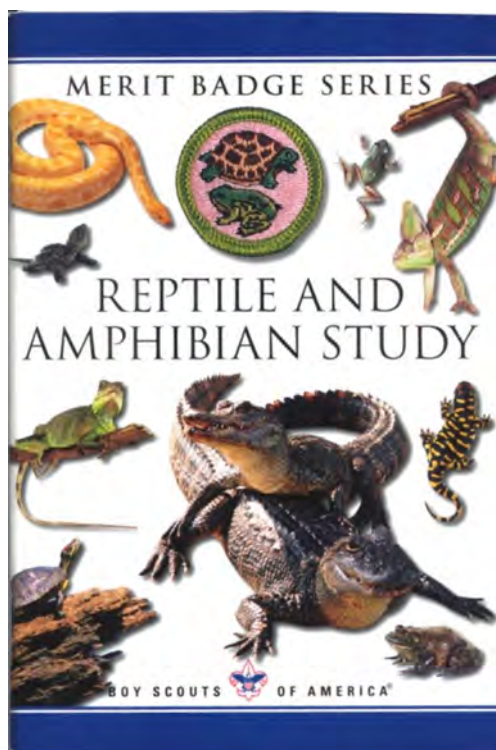
Type 8 - Conant – 1980



Type 8 - Gibbons – 1993



Type 8 - Stoltz – 2005



Type 9 - Stoltz - 2008

**FIGURE 1.** *Continued* . . . Pictorial History of the *Reptile Study/Reptile & Amphibian Study* Merit Badge Pamphlet Covers by Type as described by Price (1998).

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 Stolz, G. 2008. *Reptile and Amphibian Study*. Boy Scouts of America. Irving, Texas. 80 pp.

## APPENDIX 1. Comparison of original and current merit badge requirements as printed in the pamphlet.

### 1927 requirements, as found on the inside cover of Hassler (1927)

1. Know what representative species of reptiles (snakes, lizards, turtles, crocodiles) are found in his own state or locality
2. Know distribution and typical life history of the crocodilians inhabiting the United States.
3. Be able to distinguish by their shape, size, markings, heads, tails and fangs or teeth, and describe the four types of poisonous snakes. What characteristic is common to three of them? What poisonous snake is known by its vivid coloration? Know whether these snakes are aggressive or whether they bite only in self-defense. Know the location and use of poisonous fangs. Know, in a general way, the distribution of poisonous snakes of the United States. Know how far a snake can bite.
4. Know eight harmless snakes, four of which feed on destructive rodents. Know how snakes capture and eat their food. Know why all snakes are sometimes blind. Know how the young are produced – from eggs or born alive. Know something concerning the usefulness of snakes to man. Know why and how a snake sheds its skin, the function of the tongue and the difference between snakes and lizards as to eyes and ears.
5. Be able to recognize and describe five kinds of turtles, one of which shall be edible. Describe the typical life history of the turtle; where the eggs are laid, when laid, usual number, color, shape and covering. Tell how the eggs are incubated and the approximate length of the incubation period.
6. Know the position of the reptiles in the animal kingdom.  
 Explain why, where, and when reptiles hibernate, the duration of the hibernation period.
7. Know what First Aid treatment should be given in case of poison snake bite, and the reason for same.

### 2008 requirements, as found on pages 2-4 of Stolz (2008)

1. Describe the identifying characteristics of six species of reptiles and four species of amphibians found in the United States. For any four of these, make sketches from your own observations or take photographs. Show markings, color patterns, or other characteristics that are important in the identification of each of the four species. Discuss the habits and habitats of all 10 species.
2. Discuss with your merit badge counselor the approximate number of species and general geographic distribution of reptiles and amphibians in the United States. Prepare a list of the most common species found in your local area or state.
3. Describe the main differences between:
  - a. Amphibians and reptiles
  - b. Alligators and crocodiles
  - c. Toads and frogs
  - d. Salamanders and lizards
  - e. Snakes and lizards
4. Explain how reptiles and amphibians are an important component of the natural environment. List four species that are officially protected by the federal government or by the state you live in, and tell why each is protected. List three species of reptiles and three species of amphibians found in your local area that are not protected. Discuss the food habits of all 10 species.
5. Describe how reptiles and amphibians reproduce.
6. From observation, describe how snakes move forward. Describe the functions of the muscles, ribs, and belly plates.
7. Describe in detail six venomous snakes and the one venomous lizard found in the United States. Describe their habits and geographic range. Tell what you should do in case of a bite by a venomous species.

## HISTORY AND EVOLUTION OF THE BSA REPTILE STUDY MERIT BADGE PAMPHLET

8. Do ONE of the following:
  - a. Maintain one or more reptiles or amphibians for at least a month. Record food accepted, eating methods, changes in coloration, shedding of skins, and general habits; or keep the eggs of a reptile from the time of laying until hatching; or keep the eggs of an amphibian from the time of laying until their transformation into tadpoles (frogs) or larvae (salamanders).
  - b. Choose a reptile or amphibian that you can observe at a local zoo, aquarium, nature center, or other such exhibit (such as your classroom or school). Study the specimen weekly for a period of three months. At each visit, sketch the specimen in its captive habitat and note any changes in its coloration, shedding of skins, and general habits and behavior. Find out, either from information you locate on your own or by talking to the caretaker, what this species eats and what are its native habitat and home range, preferred climate, average life expectancy, and natural predators. Also identify any human caused threats to its population and any laws that protect the species and its habitat. After the observation period, share what you have learned with your counselor.
9. Do TWO of the following:
  - a. Identify at night three kinds of toads or frogs by their voices. Imitate the song of each for your counselor. Stalk each with a flashlight and discover how each sings and from where.
  - b. Identify by sight eight species of reptiles or amphibians.
  - c. Using visual aids, give a brief talk to a small group on three different reptiles and amphibians.
10. Tell five superstitions or false beliefs about reptiles and amphibians and give a correct explanation for each. Give seven examples of unusual behavior or other true facts about reptiles and amphibians.

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## Book Review

### The Eponym Dictionary of Reptiles.

Beolens, Bo, Michael Watkins, and Michael Grayson (2011).  
The Johns Hopkins University Press, Baltimore, i-xiii + 296 pp.

Olivier S. G. Pauwels<sup>1</sup> and Richard Wahlgren<sup>2</sup>

<sup>1</sup>Département des Vertébrés Récents, Institut Royal des Sciences naturelles de Belgique,  
Rue Vautier 29, B-1000 Brussels, Belgium, [osgpauwels@yahoo.fr](mailto:osgpauwels@yahoo.fr), [www.pauwelsolivier.com](http://www.pauwelsolivier.com)

<sup>2</sup>Prennegatan 23B, SE-223 53 Lund, Sweden, [richard.wahlgren@live.se](mailto:richard.wahlgren@live.se)

An eponym is the name of a person, feature or thing after which a particular item, in this case a reptile, is named. This is what the book is about. The book deals with both vernacular and scientific names. To cite the authors: “The names honor 2,330 individual people, but there are also 99 that sound like people’s names but in fact are not, plus 15 indigenous peoples, 5 fictional characters, 2 biblical references, and 34 references to mythology.” The dictionary is undeniably a textbook as there are no illustrations other than the cover image, which is a composite picture (actually four of them) of various unnamed, but numbered, reptiles against a natural background with a definite 19<sup>th</sup> century encyclopedia style. The source is not mentioned but we can attribute at least the *Boa constrictor* to an early German edition of Brehm’s Thierleben. The book is divided into three main parts: a three-page introduction, the dictionary itself (294 pages) and a short bibliography (two pages).

Each biography includes a list of the common and/or scientific reptile names associated to and biographical notes of the nominee. The latter are variable in type of contents, but the length of the treatment does not necessarily reflect the herpetological significance of the person portrayed. The authors even state that often the opposite is true. Biographies are arranged by alphabetical order of the eponyms, but this could be a family name, a given name, a full name, even a nickname or other reference such as a place, a ship, a tribe, etc.

When the eponym is a relative of the describer then the full name and the relationship are usually all that is said and when the eponym refers to a person who found or collected a type usually nothing more than the full name of the individual is mentioned.

The nationality of the person honored is rarely mentioned, and years of birth and death are irregularly stated for modern honored persons. One or two publications authored or coauthored by the person honored are usually listed although without exact reference. The publications are quite randomly chosen as they are rarely representative of the person’s specialties or career and there seem to be no more focus to herpetology than other biological disciplines. Sometimes no publication is mentioned, although the person did publish. The authors in most cases do not mention where the biographical information presented originated from although it is apparent that the original etymological descriptions are not the main sources. The web-supported Reptile Database is largely used for the scientific names.

We clearly consider the authors have done both hard and good work in obtaining the information assuring its biographical, bibliographical and taxonomical accuracy. But there are imperfections. In a number of cases, the biographical information is out of date. For example, Barry Hughes is said to be “a British herpetologist who works at the Department of Zoology, University of Ghana.” Actually, Hughes (b. 1935) left that university in 1986

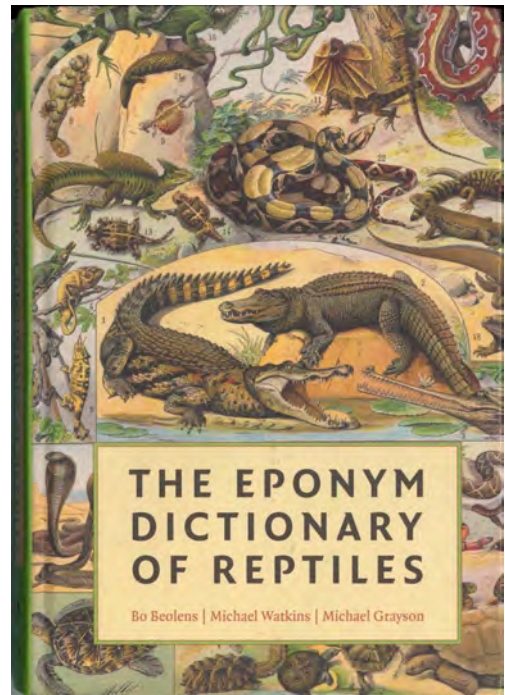


and has since then become an independent researcher (Hughes, pers. comm., Jan. 2012). The biography of Richard Shine, who is still an active herpetologist, stops with events in 1988.

Lars-Gabriel Andersson (1868-1951) was indeed a devoted full-time volunteer at Naturhistoriska Riksmuseet in Stockholm for two short periods and a prolific author, but his profession was not that of a Professor in the academic sense; instead, he was the Headmaster at Lidingö high school. He was not a collector and did not take part in any overseas expeditions as is stated by the authors.

Oskar Böttger (or Boettger) (1844-1910) has an eponym list consisting of an impressive 25 entries out of which he is the describer of eight taxa while “boettgeri” is used in another 16 scientific names published by various describers. The remaining entry, *Rhabdophis callistus* A. Günther, 1873, has mysteriously been allocated the vernacular name Boettger’s Keelback (also by the Reptile Database) for no apparent cause. *Anolis boettgeri* and *Stenocercus boettgeri* were both described by Boulenger in 1911 and are part of the list, but G. A. Boulenger was not honoring Oskar Böttger at all in these cases. Instead, he was referring to Mr. Enrique Böttger (1856-1944), the collector of the specimens in Huancabamba, Peru. The Reptile Database is also erroneous here.

In a number of cases the person to whom a taxon was dedicated could not be identified with certainty, most often because the original description provided no etymology, or only a vague one. However, information on a number of them could have been retrieved if the authors had contacted the taxon describers, when possible. That this was feasible is shown here as the first author of this review contacted a number of describers in order to clarify situations with ambiguous eponyms: Pérez-Ramos and Saldaña-de La Riva in 2008 definitely named *Sceloporus druckercolini* (Phrynosomatidae) after Dr. René Raúl Drucker-Colín (b. 1937),



a Mexican physiologist and neurobiologist, etc., which the authors only could assume (pers. comm., Jan. 2012). Patrick Couper confirmed to us (pers. comm., Feb. 2012) that *Saltuarius kateae* Couper, Sadlier, Shea & Wilmer, 2008 (Carphodactylidae) was named for his wife “who has always encouraged and actively supported my field activities”. About *Strophurus krisalyis* Sadlier, O’Meally & Shea, 2005 (Diplodactylidae) Ross Sadlier informed us (pers. comm., Feb. 2012) that Kristin Alys Sadlier is his 25 years old daughter. He could also confirm to us that *Graciliscincus shonae* Sadlier, 1987 (Scincidae) is named after Shona Sadlier his former partner. The etymology provided for *Phelsuma hoeschi* Berghof & Trautmann, 2009 (Gekkonidae) only states “Udo Hoesch discovered this species” (copied from the Reptile Data Base). Hans-Peter Berghof (pers. comm., Feb. 2012) added that Hoesch is a German amateur herpetologist specialized in *Phelsuma*, who travelled more than 20 times to Madagascar to study them. The original description of *Sphaerodactylus ladae* Thomas & Hedges, 1988 (Sphaerodactylidae) stated that the name was chosen “in honor of a

reliable companion who steered us into many otherwise inaccessible areas in Hispaniola”. Beolens et al. hypothesized that it refers to a Lada car. Blair Hedges confirmed it to us: “It had high clearance, like a jeep, which allowed us to reach the locality; we were a bit cryptic about the etymology because the car was from the Soviet Union, my funding was from the U.S. government, and it was still the Cold War” (pers. comm., Feb. 2012). Under the heading Sons, the etymology of the original description of *Liolaemus filiorum* Ramirez Leyton & Pincheira-Donoso, 2005 (Liolaemidae) stated that it was dedicated to “the sons”, without further indication. The compilers suggested that they might be the sons of Ramirez Leyton. Daniel Pincheira-Donoso informed us (pers. comm., Feb. 2012) that the species was indeed dedicated to Ramirez-Layton’s sons, Marcelo and Alvaro. The authors indicated that they have no information about Bertrand Vanmeerhaeghe, who was dedicated *Mauremys leprosa vanmeerhaeghei* Bour & Maran, 1999 (cited as “Bour and Jerome” [sic]) (Geoemydidae). Jérôme Maran and Roger Bour informed us (pers. comm., Mar. 2012) that Vanmeerhaeghe (1950-1995) was a French chemist. He was a close friend of Roger Bour, passionate since his childhood about amphibians and reptiles, especially *Mauremys leprosa*. Under the heading Zully about *Liolaemus zullyae* Cei & Scolaro, 1996 (Liolaemidae), the authors wrote “Mrs. Zully Ortega de Scolaro is presumably the junior author’s wife (or mother)”. Alejandro Scolaro informed us (pers. comm., Feb. 2012) that the species was indeed dedicated to his wife and that she is a very enthusiastic lover of field work. We tried also to help solve the mystery around the etymology of “buleli” in *Lepidodactylus buleli* Ineich, 2008 (Gekkonidae), but so far Ivan Ineich prefers to maintain it secret (pers. comm., Feb. 2012), as expressed in the original description!

The authors largely based their list of common names on that provided in Frank and Ramus’s (1995) guide to the scientific and common names of amphibians and reptiles. That

book, as also the authors rightly stressed, contains a lot of mistakes and a number of new common names that Frank and Ramus seem to have freely coined, among others after friends, family members or even after themselves. The origin of many names is mysterious and difficult to trace or contain transcription errors, e.g. “Bleck’s” Kukri Snake for *Oligodon waandersi* Bleeker, 1860 (Colubridae), a too flagrant transcription error by Frank and Ramus not worth mentioning in the Eponym Dictionary. Citing an alternative common name “Challenging” Shade Skink for *Saproscincus challengerii* Boulenger, 1887 (Scincidae) when the name actually is derived from the ship Challenger is good enough as there is a funny aspect. About “Southern” Leposoma for *Leposoma southi* Ruthven & Gaige, 1924 (Gymnophthalmidae), the authors stressed that it “apparently arises from a misunderstanding of the binomial *southi*” and, although they have provided a short biography for John Glover South, they did not propose a correct English common name to apply to the taxon. By not proposing more adequate names we fear that the authors contribute to propagate the use of many incorrect common names. Actually, we find it a bit meaningless to include common names in such a dictionary, and would have preferred to see it limited to scientific names.

While reading the Eponym Dictionary, we thought about a number of taxon names derived from persons names, that we did not find: *Bachia* Gray, 1845, *Chelonoidis nigra darwini* (Van Denburgh, 1907), *Corallus blombergi* (Rendahl & Vestergren, 1941), *Cuora chriskarannarum* Ernst & McCord, 1987 (a synonym of *C. pani* Song, 1984), *Dipsadoboa duchesnii* Boulenger, 1901, *Gerrhosaurus bulsi* Laurent, 1954, *Lepidothyris hinkeli joei* (curiously, the etymology of “hinkeli” is provided, but not that of “joei”, although both taxa were described in the same revision by Wagner et al., 2009), *Melanochelys trijuga parkeri* (Deraniyagala, 1939) and *M. t. wiroti* (Reimann in Wirot [Nutaphand], 1979), *Naja annulata stormsi* (Dollo,

1886), *Oreocryptophis porphyraceus coxi* (Schulz & Helfenberger, 1998), *Platysternon megacephalum shiui* Ernst & McCord, 1987, *Poromera haugi* Mocquard, 1897 (synonym of *P. fordii* (Hallowell, 1857)), *Siebenrockiella* Lindholm, 1929, *Trachemys gaigeae hartwegi* (Legler, 1990), *T. nebulosa hiltoni* (Carr, 1942), *T. stejnegeri malonei* (Barbour & Carr, 1938), *Walterinnesia* Lataste, 1887, and many more.

The bibliography is less than two pages and comprises mostly a list of journal titles in which the authors found information useful to their book. It is unfortunately of very limited use, since it is not referred to in the main text, and moreover very incomplete, as obviously the authors had to have recourse to many more references to write the book.

Setting aside some gaps and inconsistencies mentioned above, we really took great pleasure in reading this opus. Not a single page was boring to study, because the authors used an appropriate style and selection of biographical anecdotes to keep the reader happily entertained. None of the authors is a herpetologist, and they thus provided us with an external, objective view of what made the most exciting known facts of the lives of all these people who were dedicated reptile taxa, inspiring respect to many of them, especially those who dedicated their lives to making scientific collections in difficult times or extraordinarily challenging conditions. There are remarkably few mistyping, and they seem mostly concentrated in the French names and titles, the remaining mistyping bearing mostly on authors' names and scientific names. We regret that the high price of the book (on the Internet we found it variously priced £41, €58, and \$65) might discourage a lot of potential readers and libraries from buying it.

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